



Scientists and Oyster Farmers Partner to Monitor Coastal Conditions

Kristine Holderied¹, Scott Pegau², Kaitlin Schott³, Simeon Smith², Ori Badajos²

¹ NOAA Kasitsna Bay Laboratory, Seldovia Alaska ² Kachemak Bay National Estuarine Research Reserve, Homer Alaska ³ University of Wisconsin at Madison, Madison, Wisconsin

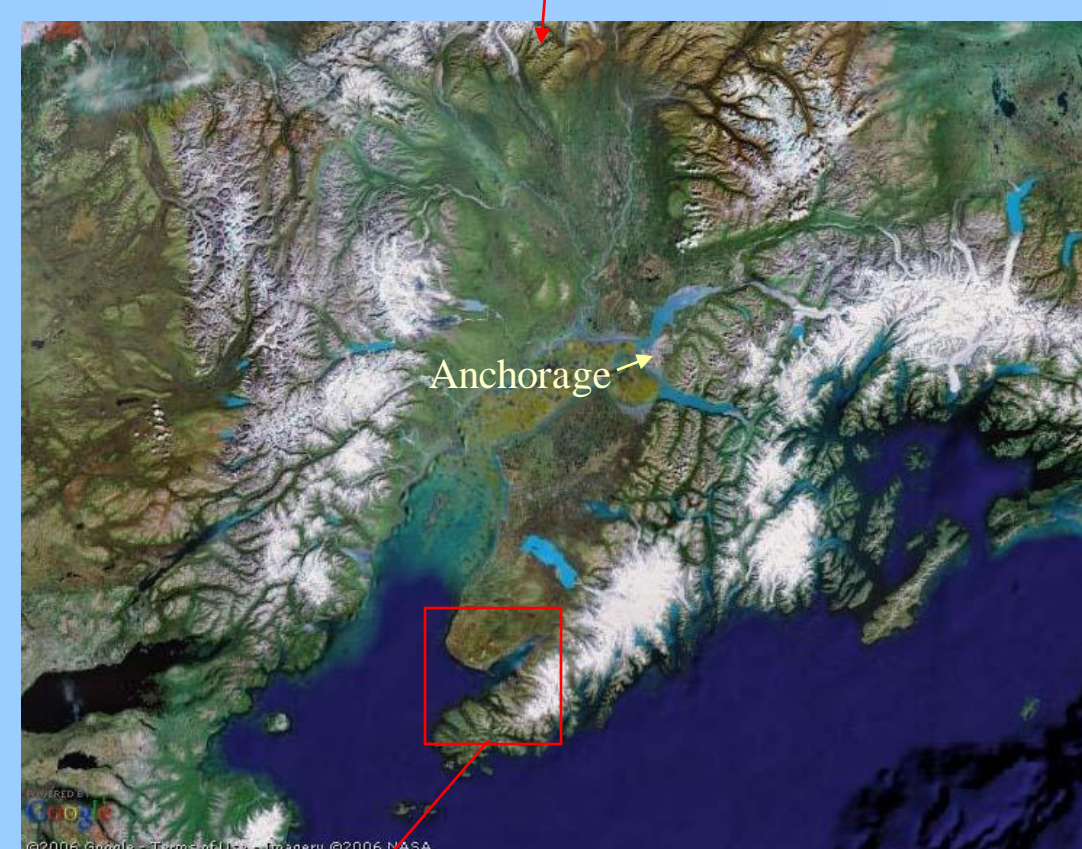
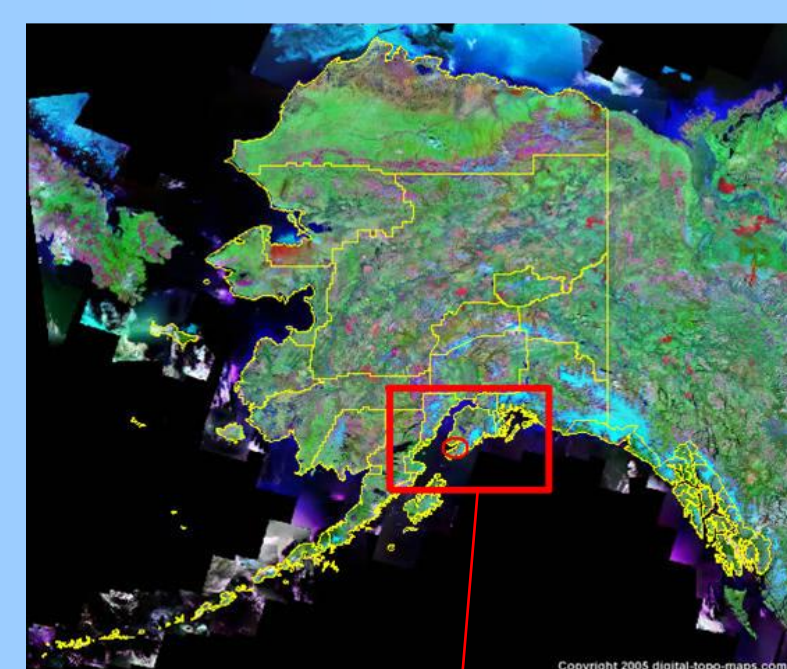


Abstract

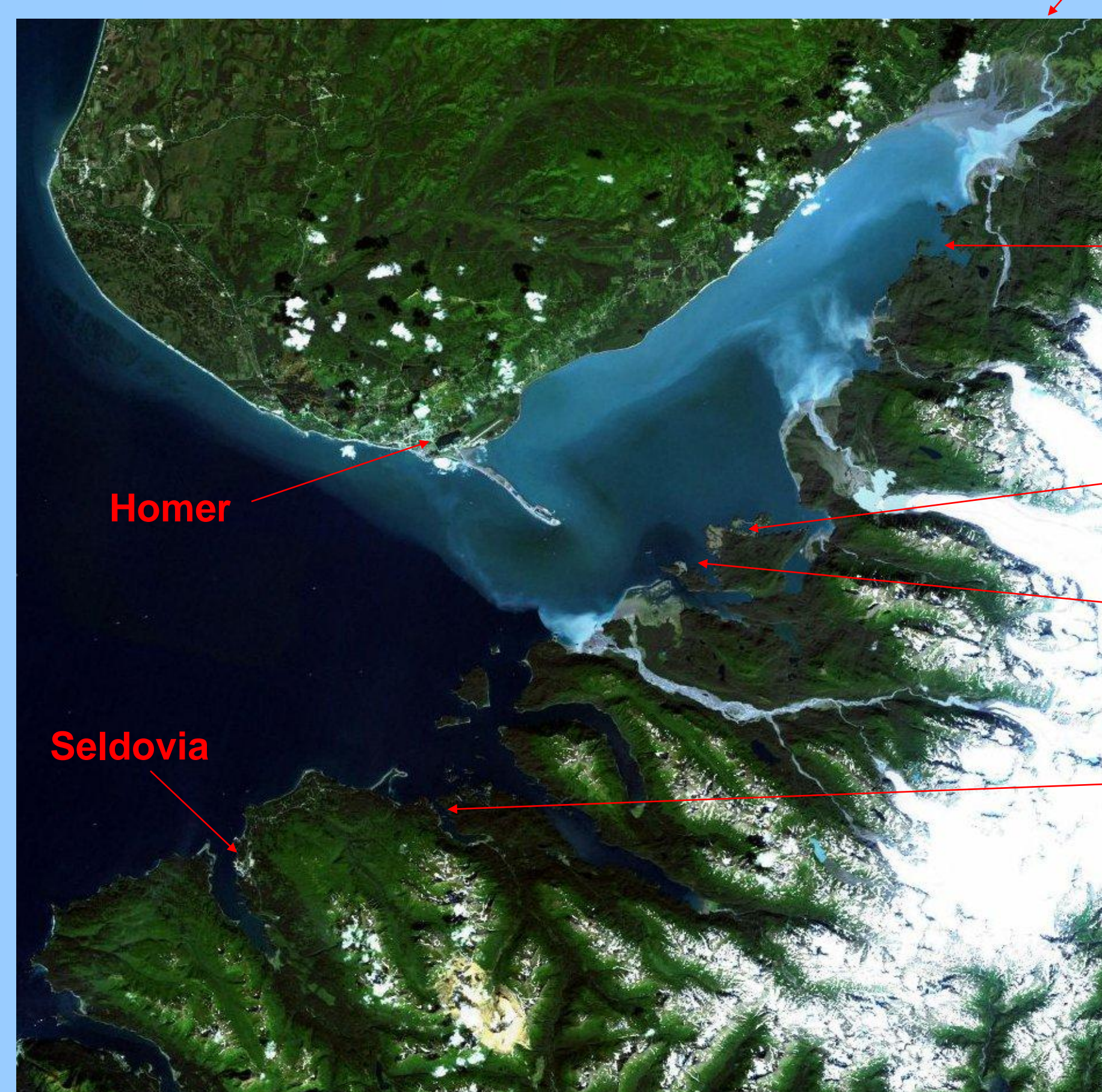
Science-based resource management and efficient mariculture operation both require understanding of variability in coastal conditions, and an agency-industry partnership to obtain such information has been developed in southcentral Alaska. The Kachemak Bay National Estuarine Research Reserve (KBNERR) and the NOAA Kasitsna Bay Laboratory (KBL) are working with oyster farmers in Kachemak Bay to monitor ocean conditions, including temperature and plankton measurements. Recently observed water temperature increases in coastal Alaska pose a potential risk to the seafood industry from the accelerated growth of *Vibrio parahaemolyticus*, a cholera-like bacteria in shellfish that has limited growth in cold waters. Near-shore monitoring of temperature is also needed to help KBNERR and KBL scientists understand how large-scale changes in the North Pacific Ocean may affect local areas. The oyster farms provide a stable platform for temperature sensors, and the resulting data are being used to assess potential *Vibrio* risks, optimize farm operations, help target sites for long-term monitoring efforts, and provide information for other resource management needs. Oyster farmers also identified an operational need for plankton information, particularly on the distribution and settlement of larval barnacles and mussels. Since plankton abundance and distribution information is also needed by KBL and KBNERR for research supporting ecosystem-based management, a cooperative plankton monitoring program was developed. Plankton monitoring protocols were created to facilitate consistent data collection by a wide range of users, with sampling conducted primarily by oyster farmers trained in these protocols and sample analysis and data management handled by the KBNERR.

Introduction

The KBL and KBNERR conduct research in Kachemak Bay and the surrounding region to support state and federal coastal resource and public health managers. Oysters have been farmed in Alaska since the early 1900s, generally in small operations, using suspended culture techniques. Researchers and oyster farmers in Kachemak Bay identified parallel needs for better information on plankton distribution and temperature patterns. A joint temperature monitoring program was started in 2005 and a preliminary plankton monitoring program was developed in the summer of 2006. This cooperative research program seeks to leverage the shared capabilities and facilities of multiple organizations, as well as contributions from community volunteers, to more effectively monitor these coastal conditions.



Kachemak Bay, Alaska



Landsat composite image courtesy of the National Park Service

Plankton Monitoring

Zooplankton were collected using hand-drawn mesh net tows, with samples returned immediately to KBNERR for storage and analysis. No preservatives were used in the field to minimize use of hazardous chemicals. Surface water was collected in a 1 liter bottle for subsequent analysis for phytoplankton. Protocols were developed for both sampling and zooplankton analysis, with an emphasis on robust procedures that could be replicated with confidence.

Sampling volunteers were provided with kits in a plastic tub that included: 110 micron mesh net; lowering rope marked at 1-meter intervals to 20 meters; plastic sample bottles with waterproof labels; squirt bottle to rinse net; pencils; and copies of the written protocols.

Initial analysis efforts focused on zooplankton, since oyster farmers were particularly interested in information on the temporal variability of barnacle and mussel larvae. Barnacle and mussel growth on oyster shells and farm equipment is a serious challenge, both in terms of cleaning effort and reduced product appearance. Information on the timing of barnacle and mussel sets, using the presence of pre-settlement cyprid larva, is expected to facilitate more efficient farm operations.

Zooplankton Database									
Name	Track Number	Date/Time	Depth	Volume	Count	Species	Count	Species	Count
1	1	5/26/06 0:00	10	100	1	1	1	1	1
2	2	5/26/06 0:00	10	100	1	1	1	1	1
3	3	5/26/06 0:00	10	100	1	1	1	1	1
4	4	5/26/06 0:00	10	100	1	1	1	1	1
5	5	5/26/06 0:00	10	100	1	1	1	1	1
6	6	5/26/06 0:00	10	100	1	1	1	1	1
7	7	5/26/06 0:00	10	100	1	1	1	1	1
8	8	5/26/06 0:00	10	100	1	1	1	1	1
9	9	5/26/06 0:00	10	100	1	1	1	1	1
10	10	5/26/06 0:00	10	100	1	1	1	1	1

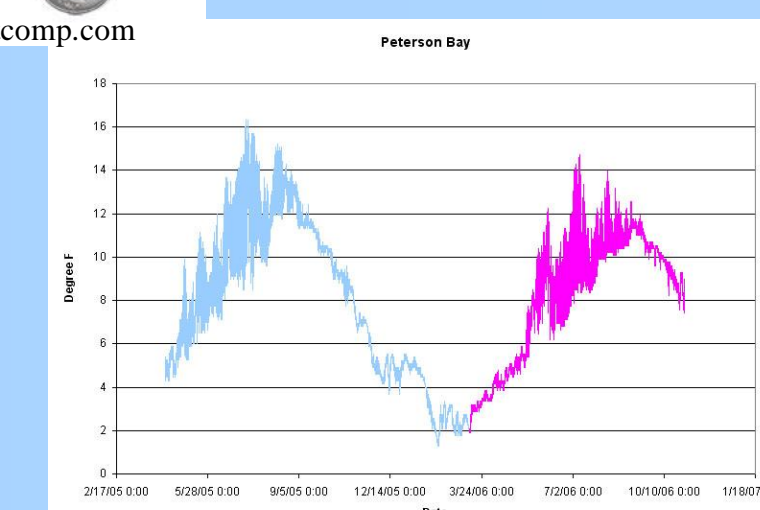


Plankton Count Information									
Collection Date	Collection Time	Collection Location	Collection Depth	Collection Volume	Collection Count	Collection Species	Collection Count	Collection Species	Collection Count
5/26/06	0:00	10	10	100	1	1	1	1	1
5/26/06	0:00	10	10	100	1	1	1	1	1
5/26/06	0:00	10	10	100	1	1	1	1	1
5/26/06	0:00	10	10	100	1	1	1	1	1
5/26/06	0:00	10	10	100	1	1	1	1	1
5/26/06	0:00	10	10	100	1	1	1	1	1
5/26/06	0:00	10	10	100	1	1	1	1	1
5/26/06	0:00	10	10	100	1	1	1	1	1
5/26/06	0:00	10	10	100	1	1	1	1	1
5/26/06	0:00	10	10	100	1	1	1	1	1

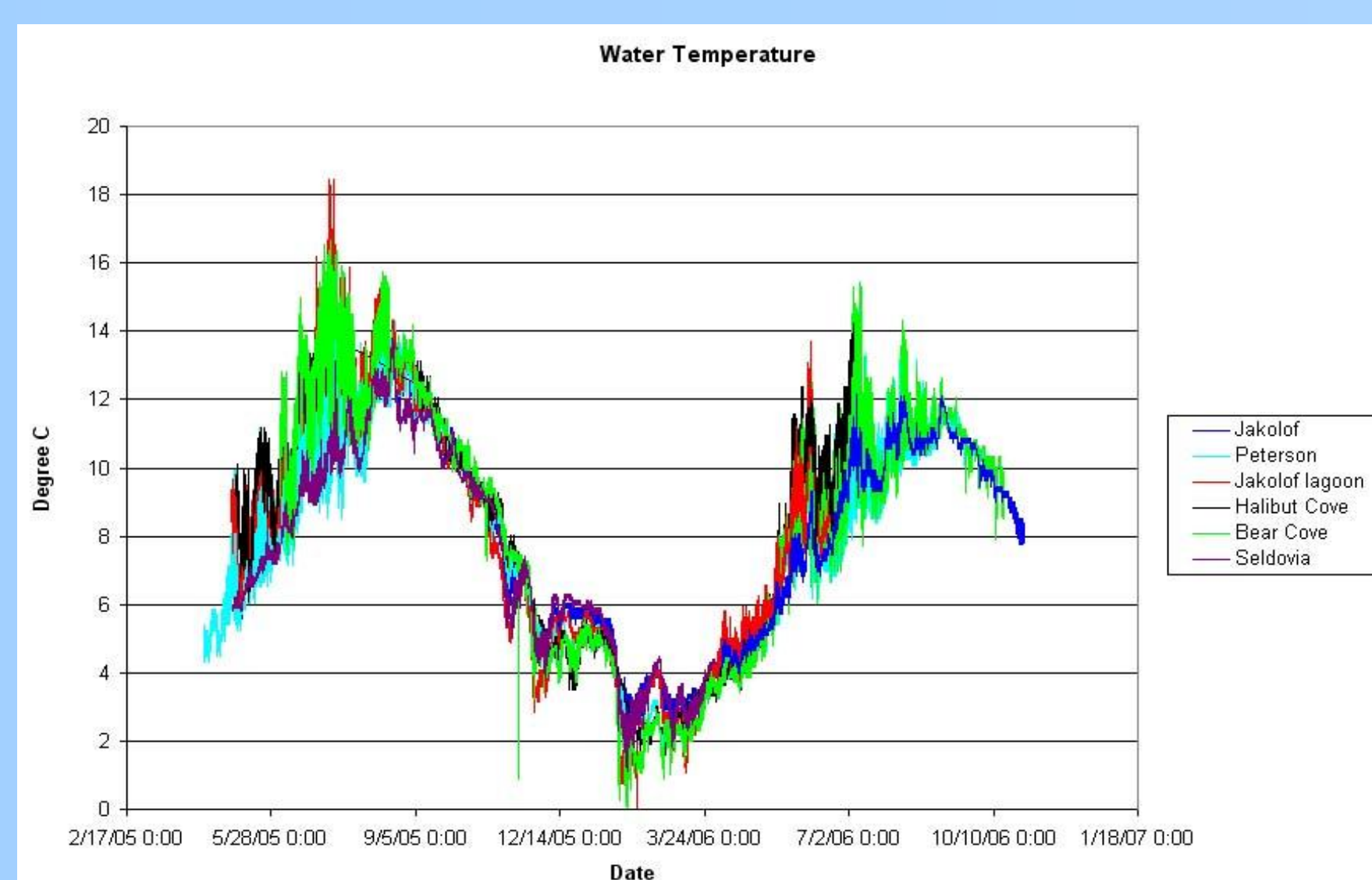
Zooplankton data collection sheets (see above) were developed to facilitate counting and identification by taxonomic group. Data collection information and zooplankton counts were entered in an MS Access database (see right).

Temperature Monitoring

Temperature monitoring was conducted using Onset Tidbit temperature data loggers (picture to right) placed on oyster farm equipment. Water temperatures for Peterson Bay are plotted on the right. The loggers record temperature data every 15 minutes and data is downloaded in conjunction with other research and monitoring efforts in Kachemak Bay, thus minimizing the overall field effort and transportation costs for this program.



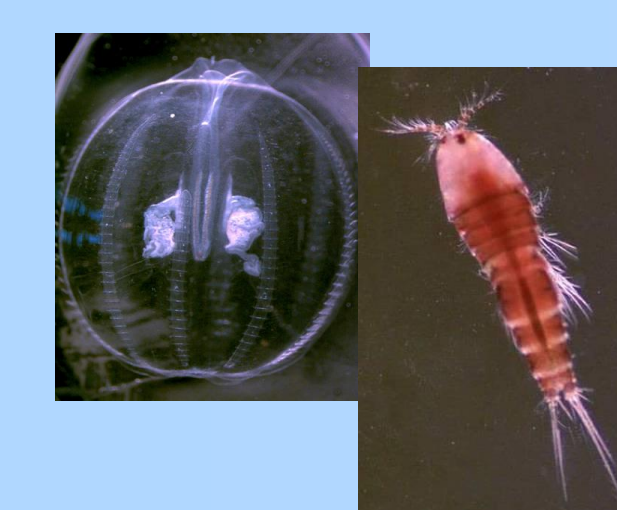
The plot below illustrates some of the seasonal and spatial variability in this data set. Temperature data is being analyzed for temporal variability and trends, as well as spatial differences between the different small bays. These data are also being combined with temperature data collected as part of the KBNERR System-Wide Monitoring Program (SWMP) and from long-term tide gauge records to assess connections between oceanographic processes in the Gulf of Alaska and environmental conditions in Kachemak Bay and its smaller embayments.



Community Partnerships

This monitoring program was developed with the assistance of many different partners, in the following roles:

- Program conception, training, oversight and technical guidance from KBL and KBNERR researchers and staff
- Initial protocol development and volunteer recruitment by an undergraduate student intern (K. Schott) working with the KBL and KBNERR
- Continued program development and volunteer training by KBNERR high school intern (S. Simeon)
- Temperature monitoring: Four oyster farms installed temperature data loggers and additional long-term records are available
- Plankton collection: Three oyster farms and the Seldovia Village Tribe provided weekly or bi-weekly samples, with additional samples collected on an opportunistic basis by KBNERR staff and a local ecotour/water taxi operator.
- Sample analysis: Student and community volunteers, coordinated by KBNERR high school intern
- Database development by KBNERR staff



Summary

Informal discussions between researchers and oyster farmers, facilitated in forums such as KBNERR Community Council meetings, prompted the exploration and development of a cooperative monitoring program to fill information needs of both groups. Preliminary temperature and plankton monitoring has been conducted, leveraging the scientific capabilities of research staff and facilities, the stable platforms of and frequent maintenance visits to the oyster farms, and the support of interested community volunteers. Written protocols were developed, volunteers were trained in their use and provided with follow-up technical support. Robust, easy-to-follow sampling and analysis procedures were used to minimize training requirements and to ensure consistent and replicable results.

This cooperative effort sought to build on existing oyster farming and research activities to the greatest extent possible, in order to create a monitoring program that can be sustained into the future. As an additional benefit, the monitoring program provided an experiential learning opportunity for students volunteers, with a clear example of how science can support local industry and resource management needs.

Acknowledgments

We thank the following people and organizations for participating in and supporting this effort:

- Rand and Marie Bader (Moss Island Oyster Farm), Mike Nakada (Northern Lights Oyster Company), Steve and Cheryl Rykaczewski (Early Tide Seafarms), Michael Opheim (Seldovia Village Tribe), and Rainbow Tours
- Grace Harrison, Catie Bursch, Mark Donohue and Nikole Tetreault for help with zooplankton analysis
- NOAA Hollings Scholarship Program for Kaitlin Schott's summer internship with KBL and KBNERR